

# Causes of Blindness and Visual Impairment in Rural Western Sahara: Outcome of Eye Camps

R Nowak, A Grzybowski, M Matuszynski

## Citation

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## Abstract

**Purpose:**This study was aimed at determining the causes of blindness and visual impairment of the population of rural areas of Western Sahara **Methods:**In 2010, three eye camps were established. 166 individuals were examined, out of which cases requiring surgical treatment were selected. Distance vision was measured with the Snellen's illiterate E-chart. In each case clinical evaluation included examination with a portable slit lamp, intraocular pressure recording and direct ophthalmoscopy. A more detailed examination of those who presented vision <math><6/12</math> in either eye was carried out. The World Health Organization (WHO) visual impairment and blindness criteria were used to define the loss of vision. **Results:** Comprehensive examination was performed on 166 subjects (141 persons aged  $\geq 40$  years and 25 persons aged  $\leq 40$  years), out of which 55 were scheduled for later surgery in the hospital in Rabuni, Algeria. 32 patients (19.3%) and 101 of the total number of eyes (30.4%) presented visual impairment. The leading cause of loss of sight was cataract. In 96.9% of all patients the determinant of visual impairment was avoidable. Because of the unfavorable, severe climatic conditions an increased number of climatic droplet keratopathy and pterygium was recorded. **Conclusions:**High percentage of avoidable blindness, with three fourths caused by cataract and refractive errors alone, indicate that appropriate programs focused on these subjects should be implemented. Chronic diseases like glaucoma stay totally out of medical control. More outreach programs should be continuously carried out in remote areas of Western Sahara until the situation in the region improves.

## INTRODUCTION

Western Sahara is a land on the north-west coast of Africa bordered by Morocco, Mauritania and Algeria. It was administered by Spain until 1976. After that, Morocco and Mauritania declared their claim to this territory. They were opposed by Polisario Front, independence-seeking national liberation movement, which proclaimed the Saharawi Arab Democratic Republic (SADR) over the entire area of Western Sahara in 1976. The tensed situation resulted in a war. Mauritania renounced all claims to the territory in 1979, however Morocco and Polisario Front continued the conflict. An unstable situation made a great number of the Saharawis flee the country to settle down in the neighbouring Algeria and live in refugee camps near Tindouf. In 1991, thanks to the United Nations' mediation, a ceasefire was negotiated. There is no exact data on the number of refugees but the United Nations estimate it at 165,000.<sup>1</sup> In fact the SADR government in Rabuni (Algeria) currently controls 20-25% of the area it claims (located behind the Moroccan Wall), while Morocco administers the rest of the disputed land (Figure 1).<sup>2,3</sup>

## Figure 1

Figure 1. Map of Western Sahara



The part of Western Sahara behind the Moroccan Wall (the Free Zone) is inhabited by approximately 30,000 nomads.<sup>4</sup>

There are no medical services. Anybody seeking a doctor must travel a few hundred kilometres to the refugee camps. However, in the camps there are no eye specialists either. An ophthalmic assistant provides first aid in ocular emergencies. Every 2-3 months a Spanish mission visits Rabuni to perform cataract surgery there. As a matter of fact, the population of the Free Zone is in the highest need for eye care services. As the density of population is one of the lowest in the world, i.e. at the level of 0.45 – 0.56 persons/km<sup>2</sup> and due to the lack of infrastructure (roads), severe climate (hot, dry conditions, sand storms, etc.) and general poverty, access to any medical services becomes frequently impossible for the Free Zone Saharawis (Table 1<sub>5</sub>). Moreover, the SADR Ministry of Health has no epidemiological data on the prevalence of eye diseases behind the Moroccan Wall. Due to all these reasons the idea of organizing outreach programs in the rural, isolated area of the Free Zone has been put into being. In cooperation with the SADR authorities three eye camps were established by ophthalmologists from the Third Eye Project (an ophthalmic project within the Lions Club of Poland).<sub>6</sub>

**Figure 2**

Table 1. Population density in Western Sahara

Total surface area of Western Sahara <sup>5</sup>	266 000 km <sup>2</sup>
The Free Zone surface area	53 200-66 500 km <sup>2</sup>
Population density (per square km) in Western Sahara <sup>5</sup>	2
Population density (per square km) in the Free Zone	0,56 – 0,45

\* calculation: 20-25% x 266 000 km<sup>2</sup> = 53 200-66 500 km<sup>2</sup>  
 \*\* calculation: 30 000/53 200 – 30 000/66 500 = 0,56 – 0,45

**METHODS**

In February 2010 three eye camps were conducted in abandoned hospitals in Bir Lahlou, Tifariti and Mehaires in the Free Zone of Western Sahara. The mobile team consisted of two ophthalmologists, one general surgeon, who played the role of an interpreter, and two drivers. A Nissan Patrol was used to transport the personnel and equipment as well as to challenge difficult off-road conditions. The company of a military vehicle was provided by the SADR authorities for security reasons. The principal aims of the project were to determine causes of blindness and visual impairment (VI) in the population inhabiting the Free Zone of Western Sahara and to provide necessary eye care.

**ETHICS APPROVAL**

Ethics approval was provided by, Poznan City Hospital, Department of Ophthalmology, ul. Szwajcarska 3, 61-285 Poznań, Poland and the SADR government. The study adhered to the guidelines of the Declaration of Helsinki.

**DEFINITIONS**

World Health Organization (WHO) categories of vision loss were used to define blindness and visual impairment (Table 2).<sub>7</sub>

**Figure 3**

Table 2. WHO categories of visual impairment

Category	Presenting distance visual acuity (VA)	
	Worse than	Equal or better than
Normal (N)		0,3
Moderate visual impairment (MVI)	0,3	0,1
Severe visual impairment (SVI)	0,1	0,05
Blindness (BL)	0,05	

Note: all parameters refer to VA in the better eye with available correction

**CLINICAL EXAMINATION**

Personal and demographic data were collected during registration. 166 patients underwent distance visual acuity (VA) testing with Snellen’s illiterate E-chart. In each case clinical evaluation included examination with the Shin-Nippon X-1 LED Handheld Slit Lamp, intraocular pressure recording with the Keeler Pulsair Intellipuff Noncontact Tonometer and direct fundus examination with a Keller Professional Ophthalmoscope. A more detailed examination of those who presented vision <6/12 in either eye was carried out. It included refraction with the Righton Retinomax K-Plus 3 Autokeretorefractometer, B-scan with the Sonomed E-Z Scan AB5500+ Scanner and dilated funduscopy. An ophthalmologist defined the cause of visual impairment in either eye. One definite cause of blindness was determined for an individual, according to the WHO criteria that the selected cause should be the one more amenable to treatment or prevention.<sub>8</sub>

**RESULTS**

In 166 patients who were examined, 25 (15,0%) were below 40 years old and 141 (84,9%) were over 40 years old. More than three fourths were males - 128 (77,1%) and 28 were females (16,9%). 32 of total number of patients (19,3%) and 101 of the total number of eyes (30,4%) presented visual impairment (Tab. 3).

**Figure 4**

Table 3. WHO categories of vision among examined patients

WHO category	VA	Age <40	Age ≥40	Total number of patients	Total number of eyes
Normal	1,0-0,3	22 (88,0%)	112 (79,4%)	134 (80,7%)	231 (69,6%)
MVI	<0,3-0,1	1 (4,0%)	11 (7,8%)	12 (7,2%)	34 (10,2%)
SVI	<0,1-0,05	1 (4,0%)	6 (4,26%)	7 (4,2%)	13 (3,9%)
BL	<0,05	1 (4,0%)	12 (8,5%)	13 (7,8%)	54 (16,3%)
Total		25 (100%)	141 (100%)	166 (100%)	332 (100%)

In the group of age over 40 years, 19 males (17,1%) and 10 females (33,3%) were visually impaired (Tab. 4).

The distribution of visual acuities in sex and age adjusted categories is shown in Table 4.

**Figure 5**

Table 4. Age and sex adjusted WHO categories of vision among examined patients

WHO category	VA	Age <40		Age ≥40	
		M	F	M	F
Normal	1,0-0,3	15 (88,2%)	7 (87,5%)	92 (82,9%)	20 (66,7%)
MVI	<0,3-0,1	0	1 (12,5%)	9 (8,1%)	2 (6,7%)
SVI	<0,1-0,05	1 (5,9%)	0	4 (3,6%)	2 (6,7%)
BL	<0,05	1 (5,9%)	0	6 (5,4%)	6 (20,0%)

M – male, F - female

**CAUSES OF BLINDNESS AND VISUAL IMPAIRMENT (TAB. 5, TAB. 6)**

**GROUP OVER 40 YEARS OF AGE**

Cataract was the single most common cause of VI with 16 cases (57,1%). Refractive error and corneal opacity were responsible for VI in 4 patients in each group (14,3% each)). Within cases with corneal opacity, one patient presenting climatic droplet keratopathy (CDK) was noted. However, CDK was present in other 19 patients (30 eyes), being mostly bilateral, but not leading to VI according to WHO standards. Posterior capsule opacity caused VI in 2 cases (7,1%). There was one subject with VI due to trachoma (grade CO), but his other eye was blind because of a different reason, therefore this case is not shown in the statistics. There were 26 cases of pterygium noted (16 bilateral and 10 unilateral). In none of these vision was impaired due to this condition. Nonetheless, 10 subjects were selected for surgery because vision was endangered.

**GROUP BELOW 40 YEARS OF AGE**

In this group, there was one case of refractive error, one of corneal opacity and one of a congenital neurological disease causing VI (33,3% each cause).

**Figure 6**

Table 5. Prevalence of common blinding conditions among examined patients presenting visual impairment (vision worse than 0,3 in the better eye)

Cause	Age<40		Age>40	
	Patients with VI	Prevalence*	Patients with VI	Prevalence**
Cataract	0		16 (57,1%)	11,3%
Refractive error	1 (33,3%)	4,0%	4 (14,3%)	2,8%
Glaucoma	0		3 (10,7%)	2,1%
CDK	0		1 (3,6%)	0,7%
Other corneal opacity	1 (33,3%)	4,0%	2 (7,1%)	1,4%
PCO	0		2 (7,1%)	1,4%
Congenital	1 (33,3%)	4,0%	0	0%
Total number of patients with VI	3 (100%)	12,0%	28 (100%)	19,9%

\*100% = 25 patients  
 \*\*100% = 141 patients  
 CDK – climatic droplet keratopathy  
 VI – visual impairment

**Figure 7**

Table 6. Principal causes of bilateral blindness and visual impairment in examined patients

Principal cause	MVI		SVI		BL	
	Age <40	Age ≥40	Age <40	Age ≥40	Age <40	Age ≥40
<b>Treatable</b>						
Refractive error	1 (100%)	2 (18,1%)		2 (33,3%)		
Cataract		8 (72,7%)		3 (50%)		5 (45,4%)
PCO						2 (18,1%)
Glaucoma						3 (27,2%)
Total treatable	1 (100%)	10 (90,9%)		5 (83,3%)		10 (90,9%)
<b>Preventable</b>						
CDK				1 (16,7%)		
Other corneal opacity		1 (9,0%)	1(100%)			1 (9,0%)
Total avoidable	1 (100%)	11 (100%)	1(100%)	6 (100%)		11 (100%)
<b>Unavoidable</b>						
Congenital					1(100%)	

CDK – climatic droplet keratopathy  
 PCO – posterior capsule opacity

**EYE CAMP OUTCOME**

55 subjects of all 166 (33,1%) were selected for later surgery in the hospital in Rabuni. Cataract in 45 cases was the cause of indication for surgical treatment (25 unilateral and 40 bilateral). There were also 10 cases of pterygium scheduled for removal (5 bilateral and 4 unilateral). Minor ocular diseases were treated on the spot, free medicines were distributed.

For each patient a case history was set. Copies of the documentation were passed to local medical officers, who were to organize transportation for the patients later on, when the Spanish surgical mission would come to Rabuni. The epidemiological documentation was handed over to the SADR Ministry of Health.

**DISCUSSION**

According to WHO about 314 million people are visually impaired worldwide and 45 million of them are blind. About 87% of the visually impaired live in the developing world., There are countries, like Western Sahara, where the years-lasting regional conflict has damaged the local medical infrastructure. General poverty, extremely difficult environmental conditions of the Sahara Desert and low population density make long-distance travelling almost impossible for the nomads inhabiting rural Western Sahara. Stationary eye services are available only in the refugee camp Rabuni, Algeria. The SADR Ministry of Health has no epidemiological data on the prevalence of eye diseases in regard to the Free Zone of Western Sahara. Currently, the idea of eye camps seems to be the only solution for reaching patients in this region.

This study is the one of a very few reports related to the ophthalmic problems in population of Western Sahara. It shows that cataract was the most common cause of visual impairment in the group of over 40 years of age (57.1%).



Cataract and refractive errors stand for three fourths of avoidable blindness in this group. This indicates that appropriate programs focused on these subjects should be implemented. During the eye camps conducted by the Third Eye Project 55 cases were selected for later surgery, including 45 cataracts.

In 96.9% of all patients the causes of visual impairment were avoidable (Table 6, Figure 2). Improving access to medical services by continuing the eye camp project would significantly decrease the prevalence of blindness in this region. The data collected during such actions will contribute to planning relevant programs by the SADR Ministry of Health.

**Figure 8**

Figure 2. Bilateral avoidable blindness: a 72-year-old man with corneal opacity in the right eye and mature cataract in the left eye



However, it should be taken into account that not only miserable infrastructure and economical problems create barriers in the access to medical services. Different studies show that in local populations fear, folk superstitions, lack of awareness of eye diseases and methods of treatment are important limiting factors.<sup>10</sup> This situation can be changed with the help of outreach programs. Eye camps can be an important tool in improving the level of education in eye health.

In some settings, like rural, isolated regions of developing countries mobile eye clinics are the only way of providing eye care services.<sup>11</sup> This solution is far from being perfect with major weakness related to chronic diseases like glaucoma, which cannot be controlled in this way. However, at the moment, it is probably the only possible solution of at least some ophthalmic problems of rural populations living in such areas of the world. We believe that in rural Western Sahara this way of reducing avoidable blindness should be carried on until stationary medical institutions successfully eradicate this problem.

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**Author Information**

**Rafal Nowak**

Department of Ophthalmology, Poznan City Hospital

**Andrzej Grzybowski**

Department of Ophthalmology, Poznan City Hospital

**Maciej Matuszynski**

Department of Ophthalmology, Poznan City Hospital